DOCUMENT RESUME

ED 461 408 PS 023 121

AUTHOR	Moore, Gary T.
TITLE	Early Childhood Physical Environment Rating Scales, Dimensions of Education Rating Scales, Observation Schedules, and Behavior Maps for the Description and Measurement of Child Care Centers.
PUB DATE	1994-00-00
NOTE	37p.; For closely related paper, see ED 377 950.
PUB TYPE	Book/Product Reviews (072)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Day Care Centers; Early Childhood Education; *Educational Environment; *Evaluation Methods; Evaluation Problems; *Institutional Evaluation; *Physical Environment; Preschool Evaluation; *Rating Scales
IDENTIFIERS	Infant Toddler Environment Rating Scale; Purdue Home Stimulation Scale

ABSTRACT

This paper reviews four scales that have been used to evaluate the physical environment of child care centers, and introduces five new scales that are designed explicitly to assess the physical environment of child care centers and their associated outdoor play environments. The psychometric properties, environmental content, and effectiveness of the Harms and Clifford Infant/Toddler Environment Rating Scale, the Home Observation for Measurement of the Environment Inventory, the Profile for Early Childhood Programs, and the Purdue Home Stimulation Inventory are discussed. The paper then discusses five sets of scales that have been developed to address the deficiencies of current physical environment scales: (1) the Early Childhood Center, Children, and Teacher Profiles; (2) the Early Childhood Teacher Style and Dimensions of Educating Rating Scales; (3) the Early Childhood Physical Environment Scales; (4) the Playground and Neighborhood Observation Behavior Maps; and (5) the Environment/Behavior Observation Schedule for Early Childhood Environments. In conclusion, the paper suggests the principle components for the development of a new, more comprehensive set of environmentally based scales for early childhood environments. (Contains 22 references.) (MDM)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 461 408

Early Childhood Physical Environment Rating Scales, Dimensions of Education Rating Scales, Observation Schedules, and Behavior Maps for the Description and Measurement of Child Care Centers[1]

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
X This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Gary T. Moore
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Gary T. Moore

Center for Architecture and Urban Planning Research

University of Wisconsin-Milwaukee

Abstract

It is well known that the quality of child care matters and that the quality of the physical environment matters. A series of scales have been developed for the description and measurement of the physical environment of child care centers, for assessing teacher styles and philosophy of early childhood education, and for systematically observing children's cognitive and social behavior in any early childhood setting. This paper reviews the need for such scales, offers a critical analysis of other scales currently available, and reports on the *Early Childhood Physical Environment Scales (EC-PES)*. In conclusion, the paper suggests the principal components for the development of a new, more comprehensive set of environmentally based scales for early childhood environments.

PS 023121

---

[1] Paper submitted for consideration to *Environment and Behavior*. My sincere thanks for assistance to Shan Sivakumaran and Nancy Genich. Running head: Early Childhood Physical Environment Scales.

BEST COPY AVAILABLE

The Need for Scales of the Physical Environment

In much of the environmental and social science literature on child care, the construct of "environment" is most often limited to the effects of aspects of the *social and organizational* environment (e.g., amount and quality of adult interaction with children) and not the physical and/or designed environment. Conversely, those designing schools and child care centers tend to ignore the role of the social environment and often espouse, if unintentionally, an environmental deterministic position.

In the child care field, a number of rating scales have been developed and are in wide use. Among the best known are the *Early Childhood Assessment Profiles* (Abbott-Shim & Sibley, 1992), the *HOME Observation for Measurement of the Environment* (Caldwell & Bradley, 1982, 1984), the various *Early Childhood Environment Rating Scales* (Harms & Clifford, 1980), the *Purdue Home Stimulation Inventory* (Wachs, 1990, 1994), and the *Accreditation Procedures of the National Academy of Early Childhood Programs* (National Association for the Education of Young Children, 1985).

There are many similarities in structure and content among these scales. All have the explicit purpose of describing and evaluating different aspects of child care programs and centers. And yet most of them focus almost exclusively on the programmatic, social, or organizational aspects of the environmental quality of child care. Few pay attention to the physical designed environment of child care centers.

The Harms and Clifford Infant/Toddler Environment Rating Scale[2]

The *Infant/Toddler Environment Rating Scale (ITERS),* developed by Harms, Cryer, and Clifford (1990), is one of the best known and most widely used scales to assess quality child care. An adaptation of the *Early Childhood Environment Rating Scale* by the same group, it consists of 35 items organized into seven subscales, each measured on a cumulative 7-point scale. It is intended for the assessment of the quality of center-based infant and toddler care for children up to 30 months of age. It is based on a broad definition of child care environments including not only what the authors call the organization of space but also interaction, activities, schedule, and provisions. It is as comprehensive as any scale available for the overall assessment of child care.

Psychometric properties. Many so-called scales are developed and promulgated in the environment and behavior field without adequate study of their psychometric qualities. Not so the ITERS. Studies show the ITERS scale is moderately reliable and moderately valid vis a vis other available scales and experts' opinions. For example, the interrater average % agreement = .47 and average % agreement +/-1 point on the scale = .78, while the average Spearman rank-order correlation among six judges r = .61, subscales r = .74, overall scale r = .84. Test-retest reliability is r = .58 to .82, subscales average r = .69, overall scale r = .79. The internal consistency using Cronbach's alpha = .83. Criterion validity is 83% across two judges in six classrooms on a simple high-low scale discrimination.

---

[2] Portions of this segment of the paper have been published previously as a test review in *Children's Environments* (Moore, 1994b).

And content validity is 49 to 82% against several comparison instruments, and 86% on expert evaluations of item importance (all statistics from Clifford, Russell, Fleming, Peisner, Harms, & Cryer, 1989).

The particular ways in which these tests were conducted were far from the most robust that could have been conducted, and the resulting figures are hardly astounding. Furthermore, several standard reliability and validity tests were not conducted (parallel forms reliability, split-half reliability, inter-item correlations, standard error of measurement of centers over a number of parallel tests, and construct validity; cf. Ghiselli, Campbell, & Zedeck, 1981). So we may conclude that the scale is somewhat reliable and valid. But is it *environmental*?

Environmental content. To assess the environmental content of the ITERS, two quantitative content analyses were conducted on the scale. Of the 35 items, 14 (40%) have some physical environmental content *(environmental* defined here as the designed or planned environment, not the social or organizational environment, i.e., that part of the total environment that can be manipulated architecturally). For example, the item "Furnishing for routine care" refers to numbers of pieces of furniture, comfort and support, storage, and child-sized, i.e., clearly a physical environmental item. On the other hand, "Nap" doesn't contain any reference to whether napping should be in separate nap rooms, in double-functioning nap/play rooms, or in partially partitioned napping spaces. The scale is silent on this important physical environmental issue, as it is on many others.

Of the 396 detailed descriptors that are used to score the scale items (e.g., "diapering done near source of hot water," or "nap is scheduled appropriately for each child"), only 35

or 8.8% have *any* physical environmental content that could help one assess the physical environment of the facility. Some of these descriptors are very good, like requiring softness and cozy special areas for high scores on "Furnishings for relaxation and comfort" and correlating the separation of activity areas from circulation with quality child care. But there are very few of them, less than 10%, despite the term "environmental" in the scale title.

Furthermore, in many places the environmental characteristics of a test item are confounded with behavioral use patterns and developmental objectives, that is, many items are double- or multi-barrelled. "Furnishings permit appropriate independence for toddlers (Ex. toddlers use small chairs...)." What is being assessed: The environmental characteristic (furnishings, i.e., the smallness of the chairs), the behavioral use pattern (that toddlers do or do not use small chairs, which could be influenced not only by the characteristics of the furniture but also by staff, whether games are spread out on the floor or on tables, and so forth), or the developmental objective (independence)?

The scale is silent on many environmental characteristics related to quality care. For example, while briefly touching on the issues of zoning and safety of children, the ITERS is silent on age-mixing, which is so much a part of many progressive programs, and on the pros and cons of different spatial layouts now known from the research literature to be important to child development. Under "Room arrangement," the scale uncritically assumes one overall organizational pattern for infant/toddler centers--the box-car arrangement of a double-loaded corridor with self-contained classrooms. The scale is very good about the necessity for a variety of play areas for infants and toddlers (art, music and movement,

blocks, pretend play, sand and water play for toddlers), but again it is silent on the environmental characteristics that might facilitate these types of developmentally appropriate play activities.

On the items measuring "Peer interaction," not one descriptor relates to the designed environment. Yet, all other things equal, twice the amount of children's peer interaction is found in modified open plan centers than open plan centers (Moore, 1987). Similarly, regarding "Caregiver-child interaction," where again no descriptor relates to the physical setting, significantly more caregiver involvement with children occurs in spatially well-defined activity settings than in moderately defined or poorly defined ones (Moore, 1986).

The ITERS scale is also silent on a number of other environmental issues that child care directors, architects, and other designers are confronted by each time they consider the facility program for a new or renovated center. Among these are location, size of center and ways to decentralize extremely large centers, spatial density, scale, image, circulation, and character of the outdoor activity areas. Clifford et al. seem to agree with this assessment, also making the point (p. 24) that only "one or two" of the ITERS items correspond to the physical environment.

Other Early Childhood Environment Rating Scales

The same lack of physical environmental content is true also of the other available early childhood scales.

Home Observation for Measurement of the Environment

Caldwell and her colleagues (e.g., Caldwell & Bradley, 1982, 1984) developed the well-known and widely used *Home Observation for Measure of the Environment (HOME) Inventory.* The two versions, while focused on infants and preschool age children in *home* settings illustrate the lack of environmental content. For infants, the subscale of "Organization of Physical and Temporal Environment" contains items like "When mother is away, care is provided by one of three regular substitutes" and "Someone takes child to grocery store at lest once a week." These items, while undoubtedly important to the total environment of the home for children, are better conceptualized as part of the interpersonal or temporal environment, not the physical designed or planned environment. The older preschooler version under the subscale "Physical Environment" has better items such as "Building has not potentially dangerous structural or health defect" and "There is at least 100 square feet [9 m^2] of living space per person [or child--differs in different reports on their work] in the house."

A variation of this scale is being developed for use in a current large-scale US national study of the quality of child care. Called the *Early Childhood Child Care HOME Inventory,* the "Physical Environment" subscale now has seven items in it, including items relating to "Outside play environment appears safe," "Neighborhood is aesthetically pleasing," and "Rooms used by children are not overcrowded by furniture." While this is an improvement over the early versions of the HOME Inventory, even this scale is silent on a whole range of other physical environmental features judged from other research to be developmentally advantageous.

Bradley (1982, 1985) summarized a series of studies of predictive or criterion validity showing that the HOME Inventory administered at 6, 12, and 24 months was a better predictor of children's intellectual development at age 3 on the Stanford-Binet Intelligence Test than were the Bayley Scales of Infant Development, quite an impressive finding. The Physical Environment subscale, for instance, showed multiple correlations of 0.40, 0.39, and 0.41 at 6, 12, and 24 months with the Stanford-Binet IQ. One wonders how much better the predictive validity might have been if a wider and richer variety of physical environmental variables had been included.

Profile for Early Childhood Programs

Shim and Shibley (1992) have developed a Profile for Early Childhood Programs that is explicitly intended for use in child care centers. The Learning Environment 17-item subscale calls for a variety of *activities* to be available for children (e.g., art materials, science materials, language materials), five items deal with the arrangement of the classroom space (e.g., "At least three partitions are used to form physical boundaries and definition for at least three learning areas"), and two items pertain to whether or not the classroom environment reflects the child as an individual (e.g., "An area exists in the room where one or two children may choose to work alone").

This scale is the most environmental of those "on the market." But while having some items pertaining to the physical environment of the "classroom," it also, like the others, is silent on a whole range of other important issues like the neighborhood context through which the child moves, the site, the organization of the building as a whole (e.g., open plan,

closed plan, or modified open/closed plan), the size of the center (and whether size is dealt with by decomposition into houses, pods, or modules, or not), and the quality of the outdoor activity areas.

Purdue Home Stimulation Inventory

The *Purdue Home Stimulation Inventory* (Wachs, 1990, 1994) is an attempt to measure physical and social parameters of the child's home environment. As stated by its author, the two physical environment subscales refer to the "physical stage upon which social-interpersonal interactions take place, rather than upon these interactions themselves" (Wachs, 1990, p. 1). This is the clearest differentiation between social and physical environmental constructs of any of the early childhood scales available even in the research literature.

But what of the items themselves? Several items are very interesting, and more physically environmental than most other scales, like "Stimulus shelter" away from noise and people, language materials "in places where child has free access to them" and small manipulables "within reach," "rooms to people ratio," "audio-visual responsive toys," "if the physical setup of the child's home is such that the child's movements are restricted within the home" (with examples for coding given), and "room decorations."

This scale, much more than any of the others, is theoretically driven. It derives from a strong view about the importance of the stimulus properties of the environment in early childhood development (Wohlwill & Heft, 1987) and especially the importance of the active

organism and of dynamic child-environment interactions (e.g., audiovisually responsive, lack of restrictions for children's movements, materials available at the child's initiation, etc.).

Lessons

What can we say are the lessons from the scales that do exist? First, many exist, and are in wide distribution and use across the United States and Canada, though I am not aware of any that exist and are in use in Europe. Second, in general they have moderate, but not great, reliability and validity. Third, and most important for our own efforts, none are particularly focused on or have major subscales dealing with the description and measurement of the physical environment as one component of the quality of child care.

Early Childhood Physical Environment Scales (EC-PES)

How might these scales be revised and modified to incorporate more physical environmental content? Or, how might a better set of environmentally based scales be developed?

A preliminary, for research-use only set of scales for the assessment of the physical environment of child care centers and their associated outdoor play environments was developed and tested in the early 1980s and has recently been revised and reissued (Moore, 1994c).

Five different sets of scales have been developed to date:

- *Early Childhood Center, Children, and Teacher Profiles*

- *Early Childhood Teacher Style and Dimensions of Education Rating Scales*
- *Early Childhood Physical Environment Scales*
- *Playground and Neighborhood Observation Behavior Maps*
- *Environment/Behavior Observation Schedule for Early Childhood Environments*

The fir . three sets of scales are measures of independent variables--the first two social environmental variables, and the third physical environmental variables. The first two sets measure four dimensions of teacher or caregiver style in early childhood settings--encouragement versus restriction, conformity versus nonconformity to routine, group versus individual teaching, and fostering independence versus restraint--as well as the overall educational philosophy of the center--openness versus closedness of educational philosophy. The third characterizes two important aspects of the layout and ambience of early childhood development centers.

The last two sets of scales measure dependent variables--cognitive, social, and motor behavior highly correlated with development. They include behavior maps and observation schedules used to describe, rate, or evaluate early childhood environments in terms of a number of predicted behavioral consequences of the social and physical environment, including group size, gender- , age- and ethnic-group mixing, degree of engagement, direction of behavior, exploratory behavior, social interaction, cooperation and competition, type of teacher involvement, and type of teacher-teacher interaction.

Early Childhood Center, Children, and Teacher Profiles

The first three profiles are used to record center size and philosophy of early childhood education of child care settings as well as the demographic characteristics of the children and professional staff. All three measure *subject group variables.* As the dependent behavioral consequences--social and cognitive development--of being in child care are influenced not only by the physical environment but also by the overall character of the child care setting including the demographic background of the children and a number of other important subject group variables, it is necessary to be able to measure and factor out these variations in order to be left with effects due to the physical environment. Said differently, as the dependent behavioral consequences of child care are based on an ongoing "treatment" (the ongoing program and design of each setting), proxy pretest measure are often made on variables believed to correlate highly with posttest scores within each group, despite being different in form from the posttest dependent scores. This is a strategy recommended by Cook and Campbell (1979) for what may be called an "untreated control group design with proxy pretest measures."

Previous quasi-experimental and correlational field studies of child care settings reported in the literature have found a variety of variables to be highly correlated with observational measures of children's and caregiver behavior (summarized in Moore, 1994c), including socio-economic status, age, gender, and size of center. These child and teacher variables are potentially pre-existing sample biases that could affect dependent measures. As randomization is impossible in most chid care studies, and therefore true experimental designs are most often out of the question, these variables need to be selected as proxy

pretest measures, both to test for equivalence or non-equivalence of samples and to use as covariates in subsequent statistical analyses. All of these variables can be measured by the *Early Childhood Center, Children, and Teacher Profiles*.

Early Childhood Teacher Style and Dimensions of Education Rating Scales

The literature indicates that various measures of teacher style and ways of teaching are highly correlated with behavioral outcome measures of developmentally appropriate child care (cf. Moore, 1994c). These subject group variables may be potentially pre-existing sample biases that can affect the dependent measures.

A number of scales have been developed and reported in the literature for measuring teacher styles and ways of teaching in preschool settings including the *Dimensions of Schooling Questionnaire, Teacher Practices Observation Form, Teacher Belief Rating Scale, Environmental Standards Profiles,* and other such scales (all references in Moore, 1994c). Some of these existing scales are cumbersome and time-consuming to administer (e.g., the *Dimensions of Schooling Questionnaire* contains 28 items each with five alternatives that must be ranked without ties and requires and elaborate scoring procedure), while others are very informal and are not susceptible to quantitative analysis (e.g., the interview procedures used by Prescott, Jones, & Kritchevsky, 1972). To measure initial group differences in teacher style and dimensions of preschool education, a compromise set of three scales were developed based on the literature and that incorporates portions of this previous work.

The *Early Childhood Teacher Style Rating Scale* measures encouragement versus restriction, conformity versus nonconformity to routine, group versus individual teaching, and

fostering independence versus restraint. A five-point Likert-type sub-scale was developed for each of these dimensions by using the variables from Prescott et al.'s (1972) work that had the greatest positive and negative factor loadings on each of these dimensions, and transforming each variable into a Likert-type item.

The *Early Childhood Dimensions of Education Rating Scale* measures practical approaches to education based on the *Dimensions of Schooling (DISC) Questionnaire* (Traub, Weiss, Fisher, & Musella, 1972). This scale measures the openness versus closedness of educational programs on 20 five-point Likert-type items measuring children's freedom to talk and move about as they please (+ loading on openness), spaces being set for the convenience of the teachers (- loading on openness), etc.

Validation. To validate both scales, a Teacher Style and Dimensions of Education Validity Check was developed for use by the directors and teachers of 16 child care centers in the greater Milwaukee area (Moore, 1982). Each director rated her staff, and all the teachers rated themselves on the six dimensions that comprised these two scales. Comparisons were made between the director's and the teacher's ratings. As each score was taken on the same subject (a self-rating and a director's rating), a paired samples *t*-test was employed. The results indicated no significant differences between self- and director's ratings on five of the six dimensions (t's ranging from 0.25 to 1.43, $df = 15$, all p's $> .10$). The only difference was that the directors thought their staff to be more open philosophically than the teachers felt themselves to be, though they did agree on their actual performance in the classroom. Though the t values were moderately low, this analysis suggests that for

research purposes only the scales are relatively valid indicators of teachers' styles of early childhood education.

Both the *Early Childhood Teacher Style Rating Scale* and the *Early Childhood Dimensions of Education Rating Scale* have been used in the work of others, e.g., by Clifford, Harms, and their colleagues in the construction and validation of their own infant, toddler, and preschooler scales (see Clifford et al., 1989).

Early Childhood Physical Environment Scales

Two scales have been developed to measure independent physical environmental variables. They are the principle instruments available to date for the systematic description and assessment of the quality of the physical environment of child care centers and related early childhood environments.

To reasonably insure construct validity for major constructs of the physical environment of child care, a detailed operational definition and rating scale have been prepared for two critical patterns in chid care centers, and for each level of each of these two patterns.

Spatial Organization Scale. The scale for Pattern 905 (from Moore et al., 1979/1994; see also Cohen, Moore, McGinty, & Armstrong, 1982) was constructed to assess the organization of the space of child care centers and other early childhood educational facilities as a whole.

The concept of open-plan facilities was introduced to North American by Educational Facilities Laboratories in 1965. Since that time, controversy has surrounded the question

fo the impact of open-plan versus closed-plan buildings (i.e., not to be confused with open versus traditional educational philosophies). Most of the data have been collected at the elementary-school level, not child care centers, so we must be cautious about making generalizations. The findings however are mixed, with some presumed advantages being ascribed to both open and closed plan schools (see Moore, 1982, 1987). These mixed findings leave open the question of which type of environment is better for development.

Analysis of the findings on closed versus open plan spatial organization led to the working hypothesis that the middle ground might be the best overall solution, that is, that what we have termed *modified open plan facilities* midway between open and closed plan might resolve the difficulties of open and closed plans while retaining their advantages (Moore et al., 1979/1994). *Modified open plan space* is the organization of space into a variety of large and small activity spaces open enough to allow children to see the play possibilities available to them while providing enough enclosure for the child to be protected from noise and visual distractions.

The scale for *modified open plan facilities* is based on ten critical dimensions of spatial organization:

1. Degree of visual connection between spaces;
2. Degree of closure of spaces;
3. Degree of spatial separation of one space form another;
4. Degree of mixture of large open areas and smaller enclosed spaces;
5. Degree of separation of staff areas from children's activity areas;
6. Degree of separation of functional areas from activity areas;

7. Degree of separation of different age groups;

8. Degree of separation of circulation from activity spaces;

9. Degree of visibility of all major activity spaces from the entry;

10. Degree of connection between interior and outdoor activity areas.

Each item is measured on a five-point semantic differential-type scale. If a particular center scores on average low across the ten measures, it would be considered a "closed plan facility" with clear separation between activity areas, i.e., a self-contained classroom plan or an egg-crate plan. If on the other hand a center scores on average high across the ten measures, it would be considered an "open plan facility" with lack of separation among activity areas. As mentioned above, our reasoning, based on the empirical literature, has been that the middle ground of "modified open plan centers" may provide settings more conducive to both cognitive and social development than either extremes of closed plan or open plan arrangements. Thus a center scoring, on average, right down the middle of these bipolar opposites would be assessed to be modified open plan.

Behavior Settings Scale. The scale for Pattern 908 (from Moore et al., 1979/1994) was constructed to assess the organization and character of particular behavior settings in child care centers and other early childhood educational facilities.

In most child care centers, much of a child's time is spent in informal, unstructured *behavior settings* with several different children working on different projects at once, some with a teacher, some on their own, some in small groups. Discussions of behavior settings generally focus more on the sociobehavioral and temporal characteristics of settings than on their physical features. Extrapolations from the limited research literature on activity

settings in child care centers led me to hypothesize that architecturally well defined behavior settings might decrease classroom interruptions and contribute to longer attention spans and greater involvement with cognitive developmental activities.

Well-defined behavior settings are areas limited to one activity, but not completely cordoned off from other activities. They are sized to accommodate 2 to 5 children plus one caregiver, and typically include storage, surface areas, equipment, plug-ins, and display space for the activity. In many child care centers, and in many of the best child care settings, one behavior setting is provided for each major developmental activity (block play, arts and crafts, music, computers, nature study, quiet reading and listening, etc.). We have sometimes termed these *resource-rich activity pockets (*Moore et al., 1979/1994).

The scale for well-defined behavior settings is based on ten dimensions, each rated on a five-point, semantic-differential-type scale:

1. Degree of spatial definition and enclosure of the behavior settings in each room or area;
2. Degree of vidual connections to other behavior settings;
3. Degree of appropriateness of the size of behavior settings for one to four children and one adult;
4. Degree of appropriateness of the amount of storage, work surfaces, and display space;
5. Degree of concentration of all resources in the settings that pertain to one activity;
6. Degree of softness;

7. Degree of flexibility;

8. Variety of seating and working positions in the behavior settings;

9. Amount of resources available in the behavior settings;

10. Degree of separation of behavior settings from circulation paths.

Reliability and validity. A number of methodological analyses have been carried out to quantitatively assess the reliability and validity of these two scales (reported in detail in Moore, 1982).

First, both to assess interjudge reliability and construct validity, three judges not familiar with the above notions used drafts of these scales to independently rate 16 child care centers in the greater Milwaukee area in terms of the organization of space and the definition of behavior settings. Average percent exact agreement among the judges on the five-point rating was moderately low (52% exact agreement across all three judges, with a low of 46% between one pair of judges). Ratings, however, were for the most part in the same direction (that is, one judge rated all settings more "critically," one more "neutrally," and one more "liberally," and these differences were consistent across settings). To see if there were any significant differences between settings in terms of these ratings, paired sample *t*-tests were calculated on the average ratings for closed versus modified centers, modified versus open centers, poorly defined versus transitional settings, and transitional versus well-defined settings. The settings were rated significantly differently from each other in all cases. Furthermore, as a second measure of construct validity, the ratings were always in line with the characterization given them by the principle investigator (*t*'s running from 1.97 to 4.14, $df = 59$ to 119, *p*'s ranging from $<.05$ to $<.001$).

Regarding criterion validity, the findings from studies using the above instruments suggest that the architecture of child care centers can lead to significant effects on a number of cognitive and social developmental variables. Controlling socio-economic differences between children and stylistic differences between teachers, subsequent quasi-experimental research with multiple levels of treatment and proxy pretest measures (Moore, 1986) has further buttressed the criterion validity of the scale by showing a number of positive advantages of modified open plan child care settings in terms of both social and cognitively oriented behaviors than either open plan or self-contained classroom settings (Moore, 1982, 1987). This scale, then, may be used to measure the degree to which any particular center approximates a modified open plan type.

Further quasi-experimental research in a set of 14 child care centers in Milwaukee County selected to represent three levels of the spatial definition of behavior settings--well defined, transitional, and poorly defined--has provided further criterion validity support for the notion that the spatial definition of behavior settings is also related positively to cognitive development (Moore 1982, 1986).

Not surprisingly, complex interactions have been found between the children's socio-economic level, teachers' philosophy of education, and the physical environment in affecting cognitive and social behavior.

Theoretical support. These findings support an ecological model of environment-behavior interactions, and have been explained by reference to an interactional theory of child development and the environment. That is, design features can have a direct impact on development, but more often they work in ecological concert with curriculum and family

structures and systems to have an impact on development. The findings have also pointed out some of the linkages between the architecturally designed environment and the social system of child care as they independently and in concern influence child care practice, social and cognitive behaviors, and, ultimately, child development.

Playground and Neighborhood Observation Behavior Maps

A structured observation instrument--a structured "behavior map"--has been developed for studying children's environments. Based on a conceptualization of the dimensions of analysis of any environment-behavior event (Moore, Tuttle, & Howell, 1985), behavior maps for applications in environmental psychology and environment-behavior studies have three major components: (1) description of the environmental setting, (2) description of the subject characteristics, and (3) description of the behavior. The setting (physical environmental variables) and subject descriptions (social environmental variables) constitute the independent variables, while the behavior observed constitutes the dependent variables. A properly constructed behavior map allows for the recording and coding of all three.

A review of the literature on child-environment relations (Moore, 1982) and observations of playground and neighborhood play settings has led to the identification of the most prevalent types of physical environmental behavior settings. A total of 11 different types of playground settings have been identified and operationally defined (e.g., gate area, houses, forts, open areas, climbing equipment). Similarly, a total of 20 different types of neighborhood settings have been identified and operational defined (e.g., residential street,

sidewalk, front yard). In addition, four conceptually different types of objects involved in play have been observed (found objects, natural objects, bought objects, and other).

Subject variables of interest in the study of play environments include age, gender, race or ethnicity, number of children in the setting, other people present, and the role of the other people.

Based on the developmental literature and preliminary observations, 26 different types of relevant play behaviors have been identified, categorized, and operationally defined (Moore, 1982) including wheel toy play, arts and crafts, fantasy play, talking, etc. They have been categorized into six major categories of social-motor, motor, cognitive-motor, cognitive, social-cognitive, and social development.

Two alternative forms of this instrument have been developed, one for playgrounds and similar planned play settings, and one for neighborhood unplanned or spontaneous play settings, with an accompanying definition and coding sheet.

Reliability and validity. These instruments have been pilot tested in both playground and neighborhood settings by two trained observers. The instruments were refined and interjudge reliabilities calculated, with percent exact agreement found to be consistently high across the entire observation schedules (84% exact agreement, $p < .001$; Moore, 1982).

Several subsequent studies have been conducted using these observation instruments to test frequencies and proportions of the six different types of play in traditional, adventure playground, and neighborhood play settings (Moore, 1982; Moore, Burger, & Katz, 1979).

Using a preliminary version of these scales, adventure playgrounds have been found to lead to more cognitive play while neighborhood play settings support more social play (Moore, Burger, & Katz, 1979).

Environment/Behavior Observation Schedule for Early Childhood Environments

Observational measurement instruments have been developed for a range of dependent variables of interest in the study of the role of the socio-physical environment of child care centers on developmentally oriented behavior. Types of dependent variables include task versus transition time, random or idle behavior, degree of engagement in developmentally appropriate activities, child-initiated activity versus staff-directed activity, exploratory behavior, types of social interactions among children, cooperative versus competitive behavior, teacher involvement versus passive watching, and teacher-teacher interactions. In developing the instrument, the child development, early childhood education, and child-environment literatures were combed for the most appropriate and most reliable existing measures, with an eye to using existing measures if possible, adapting them, or, as a last resort, developing a new instrument.

Many observational schedules have been used in the literature, but none was found that covered the above range of behaviors. For example, several observation schedules have been developed by others for observing and recording attention span in classroom settings (all references given in Moore, 1982). Another records active engagement versus disordered behavior. Still others are useful only for teacher-child interactions, or other single behaviors. Many other studies in the literature, because of using experimental designs,

measure these behaviors through pre-determined games or puzzles, a situation not applicable to a naturalistic field setting such as is favored in most environmental psychology, environment-behavior, and child-environment research. For example, the Madsen Cooperation Board is not appropriate for field settings as it involves a staged situation where children must complete a specified task under controlled conditions. On the other hand, the structured observation procedures used by other investigators, where they record a number of well-defined behaviors while children are involved in a tower building task, or other similar tasks, is instructive for field studies as they are based on activities more like ordinary events in a child care center. Similarly, other observations schedules, consisting of scales organized into categories of behavior emitted by teachers is suggestive of possible measures of types of teacher involvement.

Based on review of all of the above observational schedules, a new *Environment-Behavior Observation Schedule for Early Childhood Environments* was constructed in 1982 and revised and reissued in 1994. The main data recording sheet is comprised of three types of observations: (1) setting, (2) individuals, and (3) observed behaviors.

Under *setting,* provision is made for recording the name of the center being included in the study, the room or area being observed, the date and time, and the number of the observational cell corresponding to numbers previously indicated on a grid plan of the center and all its principle spaces.

Under *individuals* involved, space is provided for recording the number and demographic characteristics of the children and adults involved in the behavior setting (group size, numbers of children and adults, number of girls and boys, number of children

in different age categories from 2 to 6 years of age, and numbers of children of different racial or ethnic groups).

The major portion of the observation schedule is given over to space for recording *observed behaviors.* These are divided into seven sub-categories: (1) general type of behavior (engagement, transitional, functional, random, or withdrawn--for operational definitions see the coding book in Moore, 1994c); (2) initiation of behavior (spontaneous free, individual directed, or group directed); (3) exploratory behavior (immersed, somewhat involved, not involved); (4) social interaction (cooperation, competition, aggression, affection); (5) teacher involvement (co-action, encouragement, control, information, observation, presence but no involvement, no teacher present); and (6) teacher-teacher interaction (group, colleague, observation, more than one teacher but no interaction, one or no teacher present). Ordinal and interval scales have been developed within categories (e.g., distracted, attending, an immersed under the category of engagement; parallel, associative, and cooperative activity under cooperation, and so on). Each of the categories and scales have been based on the existing research literature for that behavior type. For example, Parten's conceptualization of the stages of social participation of preschool children has become one of the classics of child psychology. She introduced six categories of participation in play behavior: unoccupied behavior, solitary play, onlooker behavior, parallel play, associative play, ad cooperative play. this category system has been reused in any studies and has been simplified and reexamined in others. In the present observational schedule, Parten's six categories have been divided into two sections of the Observation Schedule. The two behaviors that are not strictly play behaviors (unoccupied and onlooker) are recorded under "general type of behavior," while

the four types of play behavior (solitary, parallel, associative, and cooperative) are recorded under "type of social interaction--degree of cooperation."

Based on these and similar considerations, a detailed set of operational definitions and coding book have been prepared for training observers, for checking interjudge reliability, and for use in observation sessions (all contained in the scale manual--Moore, 1994c). For ease of recording, the schedule itself is reduced to fit on a single page for each observational cell. Multiple copies of the schedule may be made for research purposes from the manual.

Reliability and validity. The observation schedule and coding book were developed and tested in three steps. Three test observers used the instrument in various draft forms for observing 10 behavior settings in each of two rooms at the University of Wisconsin-Milwaukee Child Care Center. Interjudge reliabilities were calculated, a debriefing occurred, and the instrument and coding book were revised after each of these sessions. Three observers used a revised instrument for observing an additional 20 behavior settings for 30 seconds each with a 2-minute recording period followed by a rest period in new settings. Interjudge reliabilities were calculated between pairs of judges, and the instrument, coding book, and time periods further refined. Two final test observers again used the instrument for observing another 20 behavior settings for 10 seconds each, followed by a 1 minute and 50 second recording and rest period. Interjudge reliabilities were again calculated between judges and are reported in the next paragraph. The final observation schedule along with all other instruments were submitted to and approved for use with infants through the oldest preschool children by the UWM Human Subjects Review Board.

To assess the reliability of the *Environment-Behavior Observation Schedule,* interjudge reliabilities were calculated after the second training and testing session (average percent of exact agreement between pairs of observers = 74.7%). After revisions of the instrument, and another retesting session, interjudge reliabilities were again calculated but in two ways. First, percept of exact agreements were calculated between the pair of observers (85.2%). Second, as the observational judgements were not just categorical, but in many cases ordinal and interval, and "percent of exact agreement" does not take into account chance agreement, Cohen's kappa (k) coefficients were calculated for all items on the observation schedule. The results indicated very high agreement between the observers (k's ranging from .66 to 1.00, only one k below .75, and average k = .86).

Conclusion: Development of a New Comprehensive Physical Environmental Scale

In our research group, we are currently working to revise and extend these scales in order to develop a still newer and hopefully more integrated set of validated scales for the description and evaluation of the *physical* environment of child care centers and related early childhood environments. These new scales are being developed for self-assessment, for monitoring, for parents concerned about quality child care, for formal post-occupancy evaluation, and as an aid in the redesign of existing centers or the design of new centers.

The above reviewed physical environment scales are based on two patterns or working hypotheses about the relation of the physical environment to cognitive behavior and

behavior developed over the past decade at the Center for Architecture and Urban Planning Research (Moore, Hill, Lane, Cohen, & McGinty, 1979, 3rd ed. 1994).

For example, the empirically based notion of resource rich behavior settings was transformed into the scale for the measurement of behavior settings in child care centers. The organization of the space of the center as a whole was made into the scale for spatial organization. Currently we are working to extend these two scales into the development of a complete package of scales for the comprehensive assessment and evaluation of the physical environment of child care.

As a first step, we have been developing a number of new design criteria for various types of child care facilities. Over the years, we have become rather convinced that somewhere around 16 patterns (some from the original 1979 patterns, some based on subsequent work especially in Scandinavia) are absolutely critical for the success of any center-based child care facility. We hope that our new *Early Childhood Physical Environment Scales* will include most of those principles as scale items with appropriate descriptors.

The 16 key principles, around which the new scale is being constructed, are organized in terms of five levels of hierarchy into a cascade of principles that we see in quality child care centers (cf. Moore, 1994a for more detail and for the rationale for these 16 principles).

The Neighbourhood Hub Model

1. *Network of Child Care Facilities.* A comprehensive child care program can be composed of family child care, group care centers for larger numbers of children

(perhaps as large as 60-75 children), and other child and family resources at the hub of a neighbourhood hub model.

2. *Favourable Location.* The best locations for child care centers are in the home neighborhood or at the workplace. But a number of positive and negative proximities must be considered (accessibility, away from busy roads, away from noxious or dangerous elements, close to natural features, close to community resources, and large enough site to accommodate the building and a variety of play yards). An ideal location can be on the seams between neighbourhoods.

3. *Center Size.* How large should the center itself be? Evidence from the U.S. National Day Care Study found that the size of group in which children spend most of their time in child care is a very good predictor of quality--smaller is better. We are recommending that no child care center be larger than 60 to 75 children (25 to 40 would be much better, developmentally speaking). And for each child, we need a total of 9-10 m^2/child [100 gross square feet GSF/c] for the building, and another 9-10 m^2/c [100 GSF/c] for outdoor play yards, drives and drop-offs, and set-backs.

Site

4. *Positive Orientation.* In most of North America and Europe, positive orientation means orienting the building, its play yards, and its indoor activity spaces toward the south to capture as much light and sun as possible. In other parts of the world, positive orientation may mean facing the building away from the sun, protecting it from the sun, or, in the southern hemisphere, orienting it north toward the sun. It is also desirable to orient the building, its indoor play areas and its windows to

favourable views, and to create favourable microclimates by the way the building defines positive outdoor activity spaces.

5. *Safe Site Circulation.* Parking and service areas should be away from children, parents coming to and from the center, and children's play areas.

Building Organization

6. *Village or Campus Plan--Identifiable Houses.* For centers serving over 60-75 children, and even for ones in the 60-75 range, the building can be decomposed into "houses" (pavilions/modules) of, preferably, 25-40 children each. Each house best serves mixed-age groupings (from infants through the oldest preschoolers) where the staff moves with the children. Each house is large enough to have all the activity pockets necessary for developmentally oriented care of these children, its own separate entrance, immediately adjacent play yards, and its own identity.

7. *Building Core.* The overall organization of the building in two or more houses surrounding a central core. The core has special facilities shared among the houses (multipurpose motor activity center, multiuse health and social services area, and special places like a children's library, greenhouse, or animal house), as well as kitchen, staff back-stage, adult lavatories, and administration.

8. *Residential Scale / Home as a Template for Child Care.* Child care centers are not just scaled down schools. For a variety of good reasons, the elementary school is not an appropriate image, template, or precedent for child care centers. Child care centers can be patterned after the prevailing residential imagery and scale of nearby houses--residentially scaled sloped roofs, materials and design details that are

compatible with the best residential quality in the surrounding community, vegetation and landscaping, covered entry emphasized, enclosed yards, intimate child play areas to attract attention, etc.--in general, the building as a friend, child scale, a friendly-face entry sequence, soft yet exuberant.

9. *Inclusiveness.* The facility should be fully accessible inside and out for developmentally challenged children and adults. It should provide flexibility of opportunities.

Houses

10. *Modified Open Space.* Each house can be spatially organized in terms *modified open space.* Not to be confused with the totally open plan of the 1960s, with all its problems, nor with the double-loaded corridor of many elementary schools, a *modified* open plan is a creative compromise that combines the best of both while minimizing the limitations of each. It is composed of semi-enclosed/semi-open activity pockets, utilizing half walls, open arch ways, glazed or unglazed windows, etc. between different age-appropriate activity pockets. Modified open space is ideal for mixed-age groupings and for mixed-age houses where age groupings are kept somewhat separate--our research has shown that it maximizes child-child interaction, sharing, participation, cooperation, and supportive staff-child interactions.

11. *Home Bases for 12-16 Children.* At the heart of each house is a home base where children come at the beginning of the day, end of the day, for lunch, potty breaks, and whenever they need a hug or some down time. Each home base serves the mixed-age family groupings of the entire house. It includes the cubbies, a small

kitchenette, an eating cluster, intimate diapering areas/learning bathrooms, separate napping areas as needed, and perhaps a quiet reading-listening area.

12. *Resource-Rich Activity Pockets.* Surrounding the home base are one or more clusters of resource-rich activity pockets (primary activity spaces), one for each of the primary developmentally oriented activities for each age group in that house. Three to four activity pockets can be clustered together, each sized for 2-5 children plus a caregiver. Each activity pocket has a sense of closure, but has cross visibility and is easily visible by an adult. Each pocket has all the teaching materials, displays, and work/play surfaces necessary for that activity. Examples of the great variety necessary: block area, art studio, music corner, science corner, reading/listening area, sand/water play, etc. Depending on predilection, and applicable child care licensing regulations, these resource-rich activity pockets may be grouped by age (some for infants, toddlers, and older preschoolers), or may be age mixed.

13. *Spatial Zoning: Noisy/Active/Messy to Quiet/Creative/Clean.* The activity pockets are best zoned to separate noisy from quiet activities, active from more creative, and messy from clean.

14. *Clear Circulation Which Overlooks.* Each house--its home base and all of its zoned activity pockets--can be organized around a clear, safe circulation path. But far from a corridor or hallway (more appropriate for elementary schools that child care centers), and far from ill-defined or ambiguous circulation paths, the circulation is best when it is clear and overlooks but not interrupts activities.

15. *Indoor-Outdoor Connections.* Child care programs are run outdoors as much as indoors (weather permitting). No longer the elementary school model of learning indoors and "recess" outdoors, developmentally appropriate activities of the best child care programs are held equally outdoors as indoors. Thus the need for wonderful connections between in and out--low windows, wide doorways from each house, etc.

Outdoor Activity Spaces

16. *Developmentally Appropriate Play Yards.* Child care center play areas can be modelled after the scale of back yards, with resource-rich activity pockets zoned appropriately and linked by clear circulation. The diversity of activities can be the same as inside (not only gross motor playing areas, but also intimate reading/listening areas, a garden and perhaps a greenhouse, several quiet areas for nurturing fantasy play, and so on). The same design principles apply as apply separate entries to each play area, organized per modified open space, with resource-rich activity pockets, appropriate zoning, and clear circulation which overlooks.

Many of these design principles are supported by empirical research on the relation between child development and the built environment. Others are based on studies conducted of child care centers overseas, and on our experience advising and working with child care centers, their directors and staff over the past 15 years in Canada, the US, Australia, and northern Europe. This combination of empirical research and reflective professional practice leaves us quite convinced that these design principles are absolutely critical for the success of any center-based child care center, and, therefore, for their description and assessment.

References

Abbott-Shim, M., & Sibley, A. (1992). *Assessment Profile for Early Childhood Programs.* Atlanta: Quality Assist.

Caldwell, B.M., & Bradley, R.H. (1982). *HOME Observation for Measurement of the Environment.* Little Rock, AK: University of Arkansas, Center for Child Development and Education.

Caldwell, B.M., & Bradley, R.H. (1984). *Rationale and Development of the HOME Inventories.* Little Rock, AK: University of Arkansas, Center for Child Development and Education.

Clifford, R.M., Russell, S.D., Fleming, J., Peisner, E.S., Harms, T., & Cryer, D. (1989). Infant/Toddler Environment Rating Scale: Reliability and Validity Study. Unpublished final report available from the Frank Graham Porter Child Development Center, University of North Carolina, Chapel Hill, North Carolina.

Cohen, U., Moore, G.T., McGinty, T., & Armstrong, B.T. (1982). The spatial organization of an early childhood development center: Open space, zoning, and circulation. *Day Care Journal,* Fall, *1*(2), 35-38.

Cook, T.D., & Campbell, D.T. (1979). *Quasi-Experimentation: Design and Analysis Issues in Field Settings.* Chicago: Rand McNally.

Ghiselli, E.E., Campbell, J.P., & Zedeck, S. (1981). *Measurement Theory for the Behavioral Sciences.* San Francisco: Freeman.

Harms, T., Cryer, D., & Clifford, R.M. (1990). *The Infant/Toddler Day Care Rating Scale.* New York: Columbia University Press.

Moore, G.T. (1982). *Some Effects of Physical and Social Environmental Variables on Children's Behavior: Two Studies of Children's Outdoor Play and Child Care Environments* (Ph.D. Dissertation, Clark University). Ann Arbor, MI: University Microfilms International, No. 83-13216.

Moore, G.T. (1986). Effects of the spatial definition of behavior settings on children's behavior. *Journal of Environmental Psychology, 6*(3), 205-231.

Moore, G.T. (1987). The physical environment and cognitive development in child care centers. In C.S. Weinstein & T.G. David (Eds.), *Spaces for Children: The Built Environment and Child Development* (pp. 41-72). New York: Plenum.

Moore, G.T. (1994a). Ready to learn: Toward design standards for child care facilities. *The Educational Facility Planner, 32*(1), 4-10.

Moore, G.T. (1994b). Review of *Infant/Toddler Environment Rating Scale.* In *Infant Environments.* Special issue of *Children's Environments,* 1994, *11*(2), 170-172.

Moore, G.T. (1994c). *Early Childhood Physical Environment Observation Schedules and Rating Scales.* Milwaukee: University of Wisconsin-Milwaukee, Center for Architecture and Urban Planning Research, Report R94-2.

Moore, G.T., Burger, H.LeS., & Katz, E. (1979). Adventure playground and neighborhood play compared. In A.D. Seidel & S. Danford (Eds.), *Environmental Design: Research, Theory, and Applications.* Washington, DC: Environmental Design Research Association.

Moore, G.T., Hill, A.B., Lane, C.G., Cohen, U., & McGinty, T. (1994). *Recommendations for Child Care Centers* (3rd edition). Milwaukee: University of Wisconsin-Milwaukee, Center for Architecture and Urban Planning Research, Report R79-2.

Moore, G.T., Tuttle, D.P., & Howell, S.C. (1985). *Environmental Design Research Directions: Process and Prospects.* New York: Praeger Publishers, now Westport, CT: Greenwood Press.

National Association for the Education of Young Children (1985). *Accreditation Procedures of the National Academy of Early Childhood Programs.* Washington, DC: Author.

Prescott, E., Kritchevsky, S., & Jones, E. (1972). *The Day Care Environmental Inventory Assessment of Child-Rearing Environments.* Pasadena, CA: Pacific Oaks College.

Traub, R.E., Weiss, J., Fisher, C.W., & Musella, D. (1972). Closure or openness: Describing and quantifying open education. *Interchange,* 1972, *3,* 69-83.

Wachs, T. (1990). *Purdue Home Stimulation Inventory: Training Manual.* West Lafayette, IN: Purdue University, Department of Psychological Sciences.

Wachs, T. (1994). *Observational Manual for Day Care Study.* West Lafayette, IN: Purdue University, Department of Psychological Sciences.